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Teschke et al.

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(54) **LOCKING PISTON ASSEMBLY**

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F15B 15/26 (2006.01)
F15B 11/00 (2006.01)

(52) **U.S. Cl.** **92/27**; 91/45; 92/26

(58) **Field of Classification Search** 91/45; 92/23, 92/26, 27, 28
See application file for complete search history.

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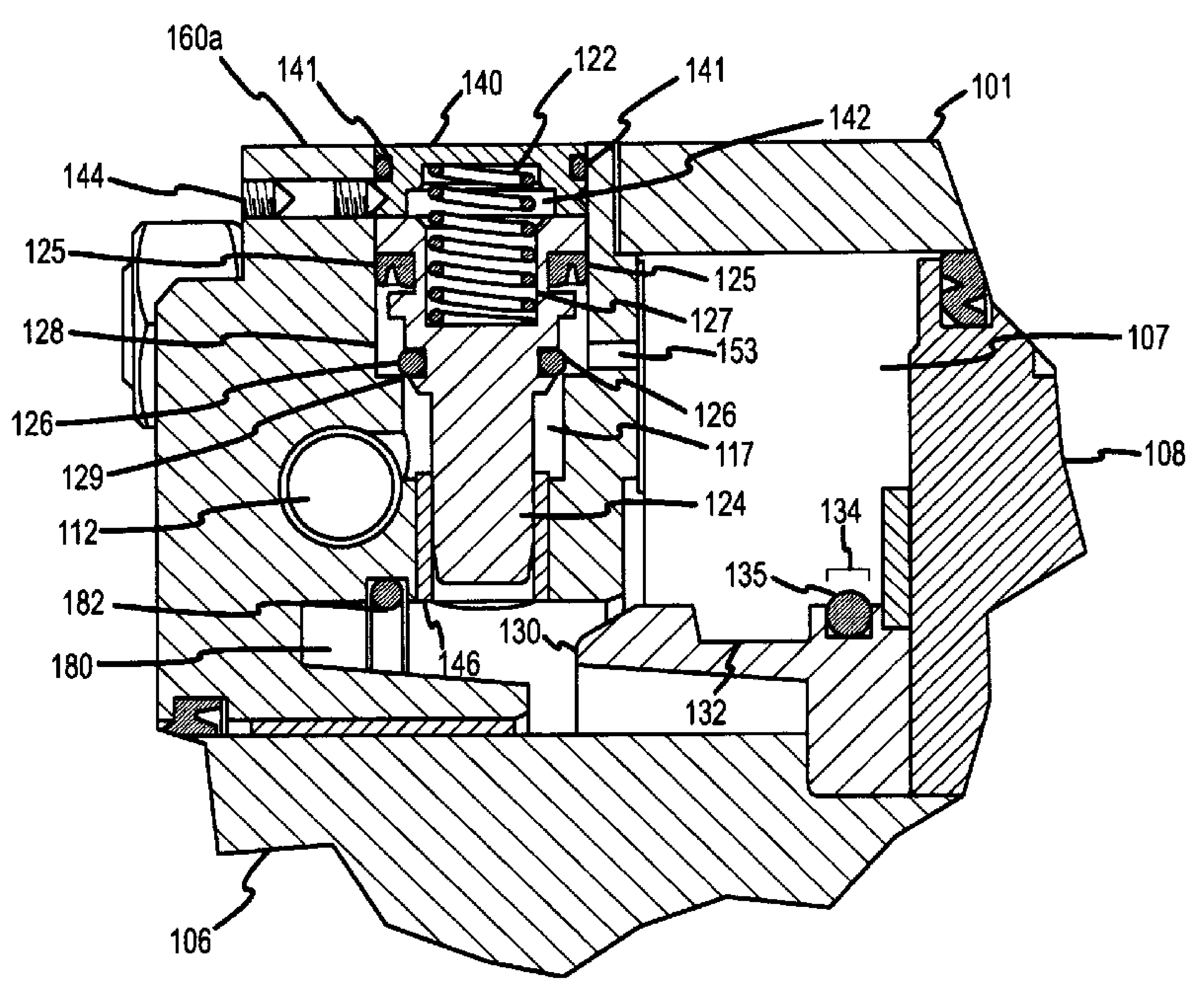
(57) **ABSTRACT**

A locking piston assembly (**100**) is provided according to the invention. The locking piston assembly (**100**) includes a piston chamber (**107**), a piston rod (**106**) configured to be substantially extended from and substantially retracted into the piston chamber (**107**), and a piston head (**108**) coupled to the piston rod (**106**) and configured to move reciprocally in the piston chamber (**107**). The locking piston assembly (**100**) further includes at least one lock (**120**) configured to mechanically lock the piston head (**108**) and the piston rod (**106**) in at least a substantially fully extended position. The lock (**120**) is configured to unlock the piston head (**108**) and the piston rod (**106**) in a presence of a pressurized fluid provided to retract the piston rod (**106**). The pressurized fluid is introduced into the piston chamber (**107**) and the piston rod (**106**) is retracted only after the lock (**120**) is unlocked.

18 Claims, 8 Drawing Sheets



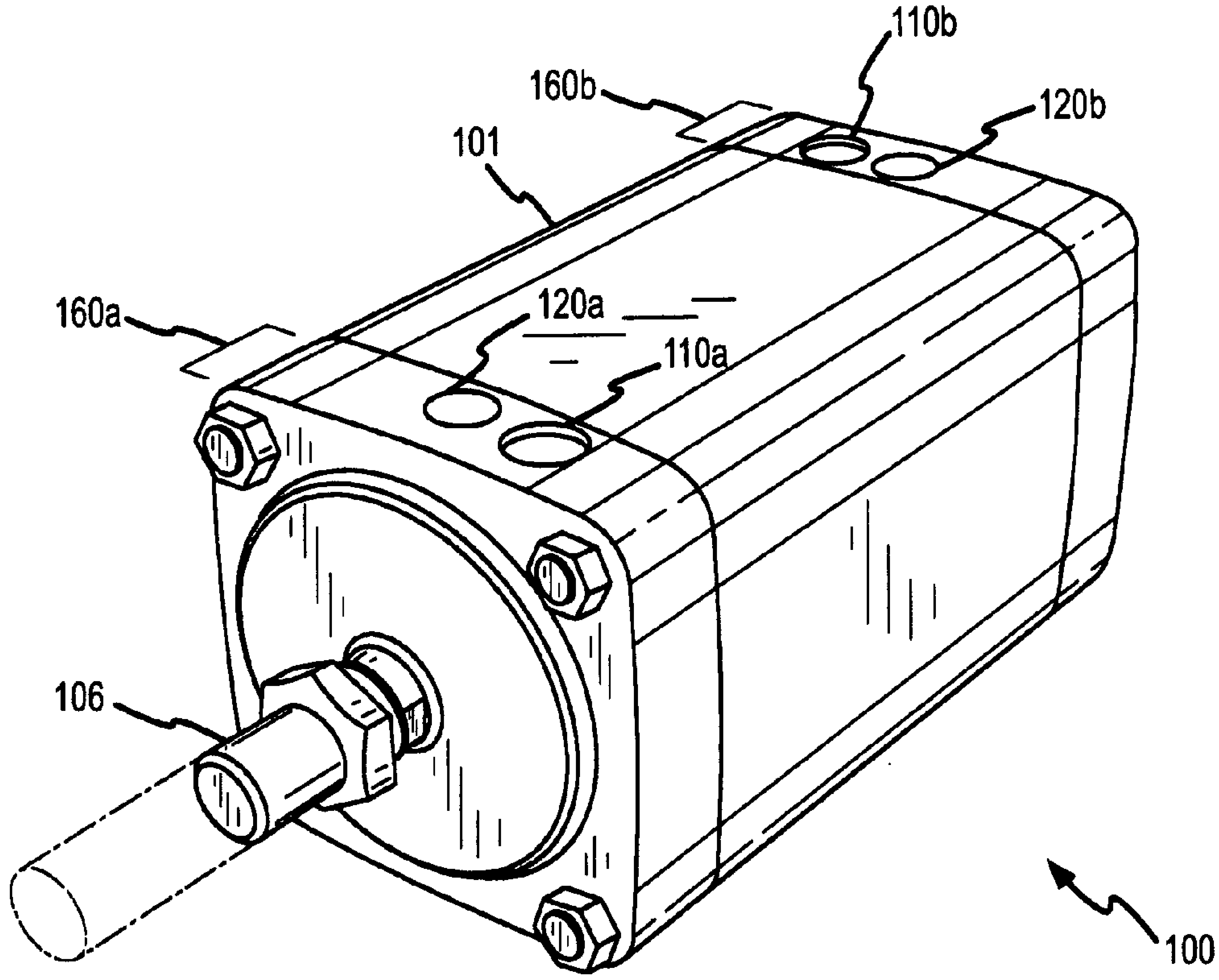


FIG. 1

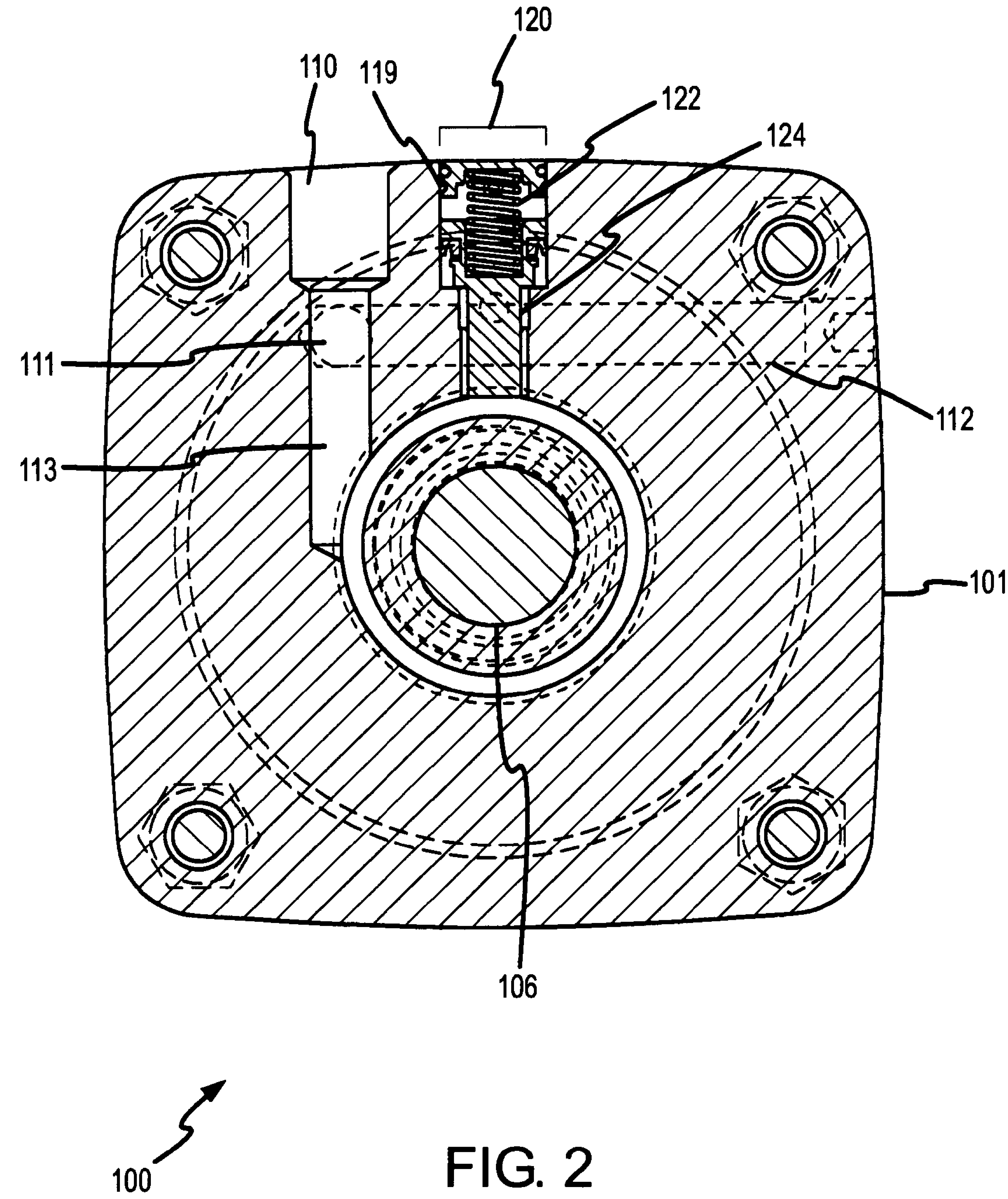


FIG. 2

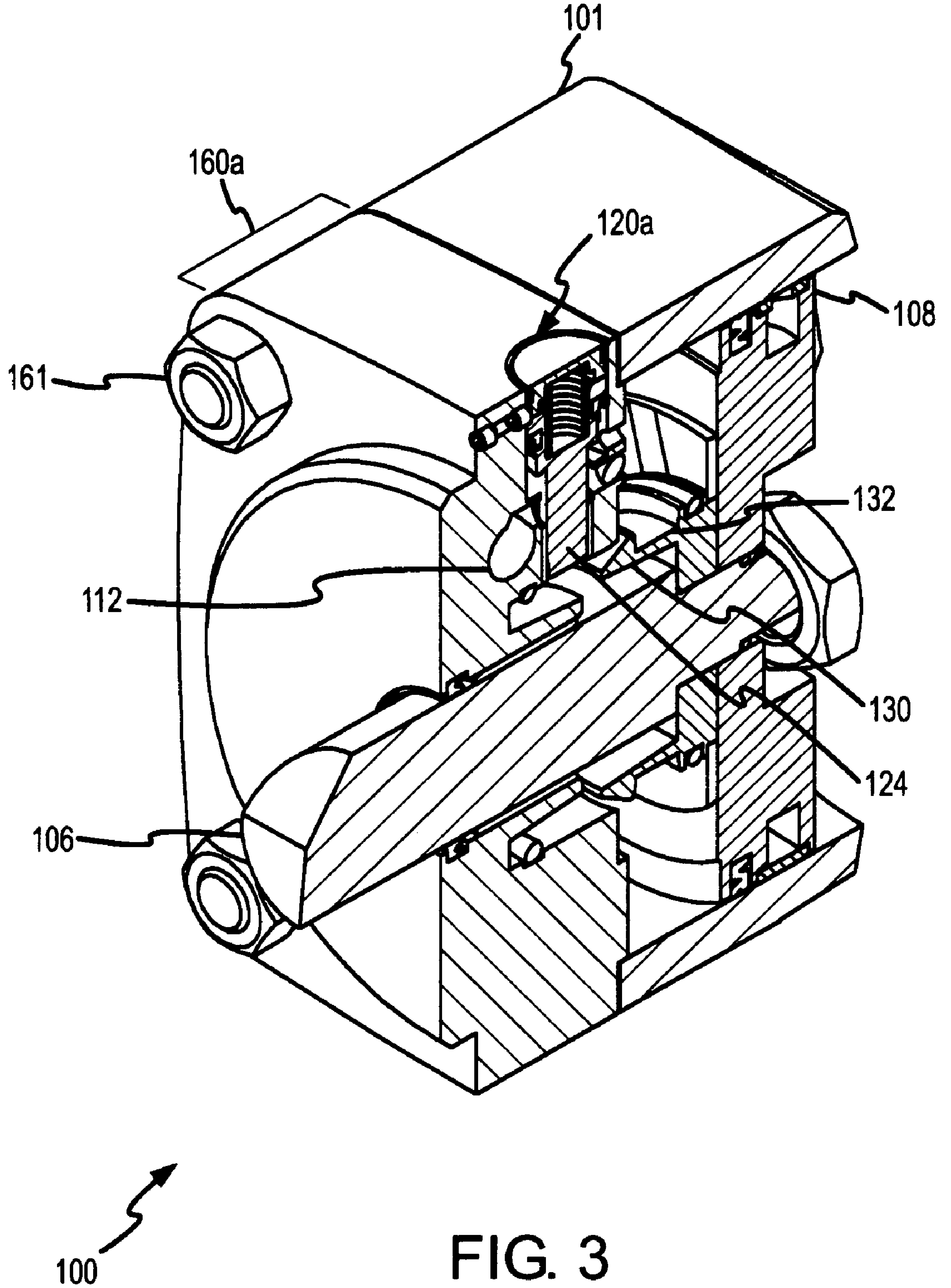


FIG. 3

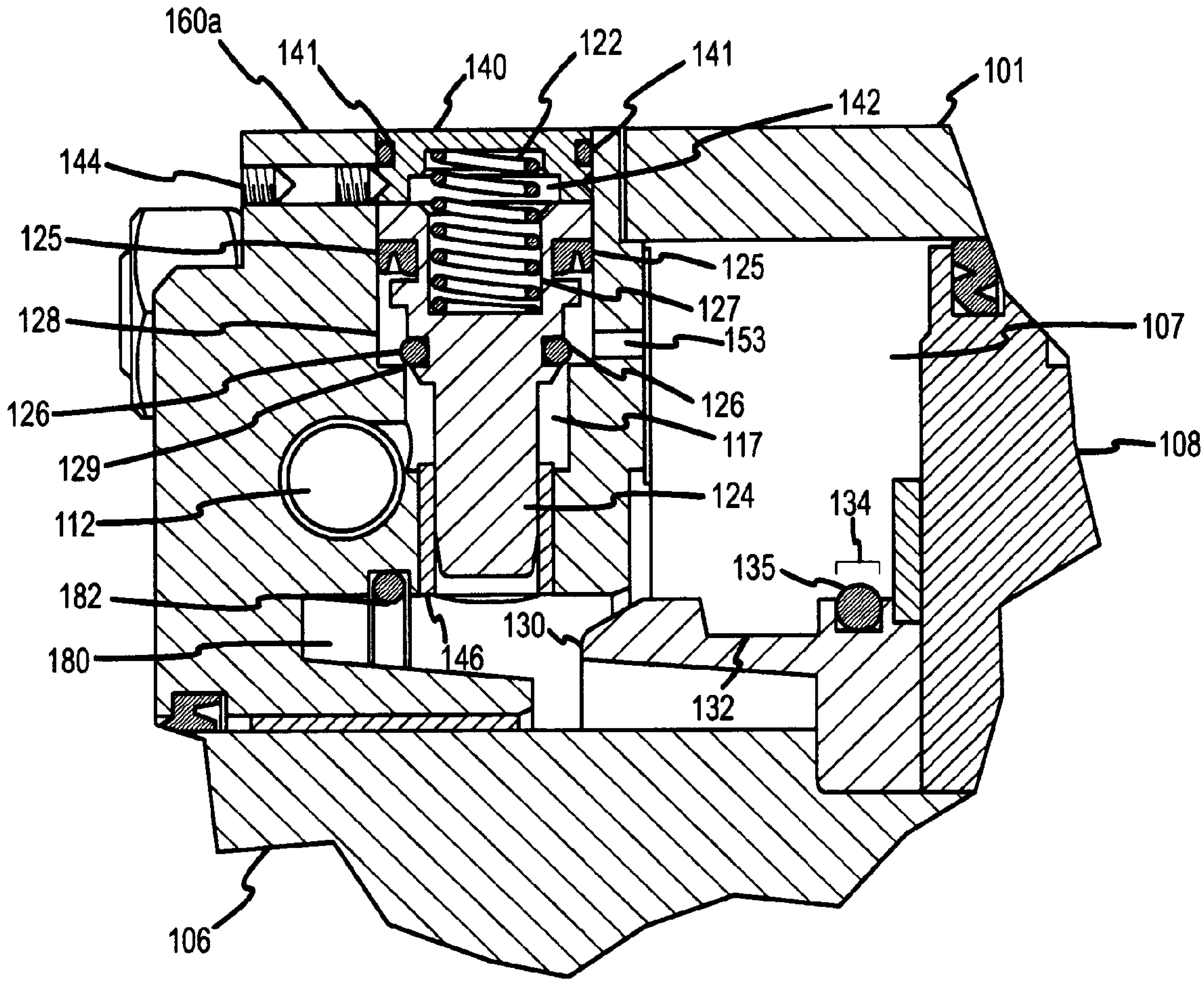

160a
141
140
122
141
101
142
144
125
125
127
128
153
107
126
126
129
117
108
124
134
112
135
182
130
146
180
132
106

FIG. 4

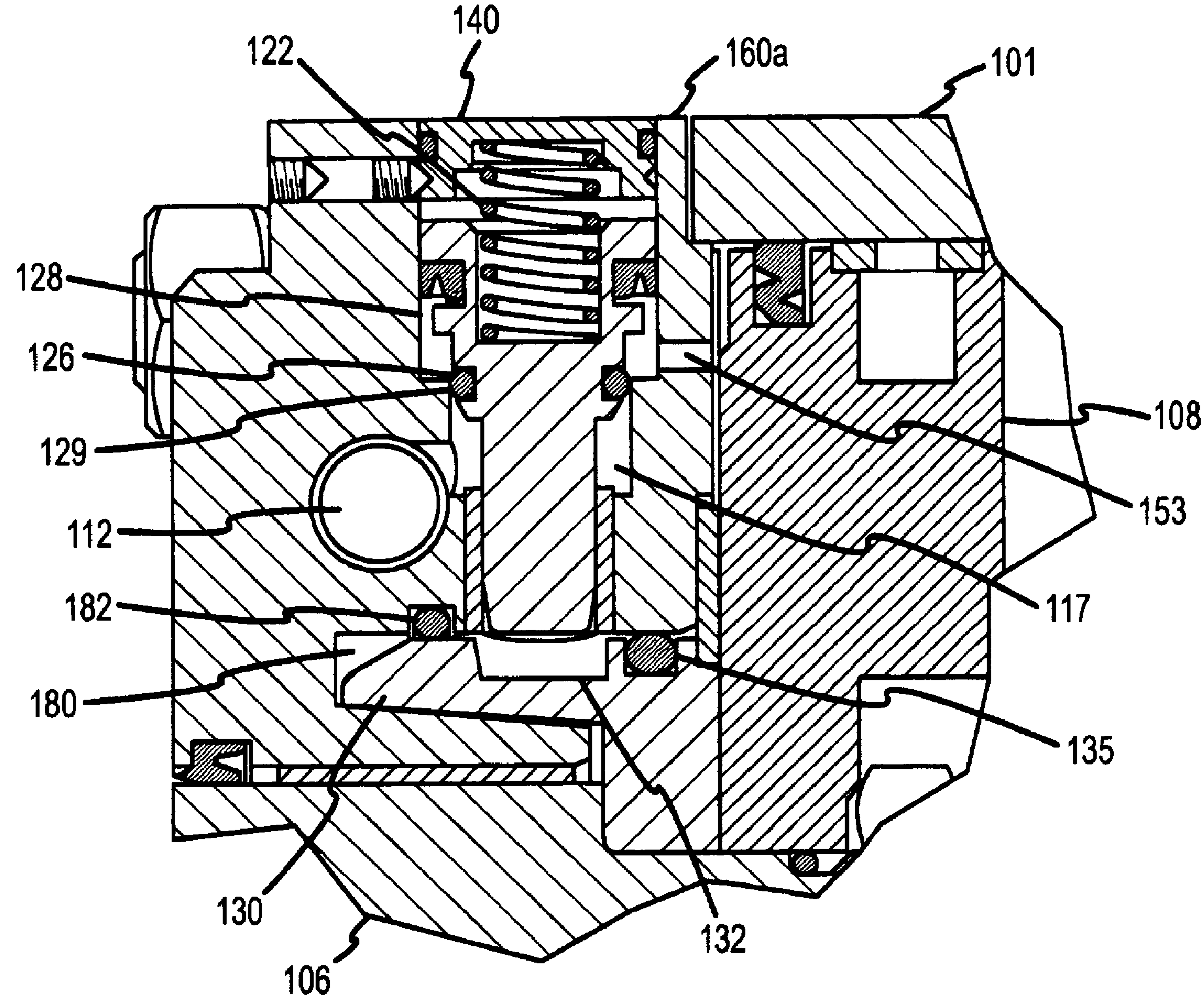

140
122
160a
101
128
126
129
112
182
180
130
106
132
135
117
153
108

FIG. 5

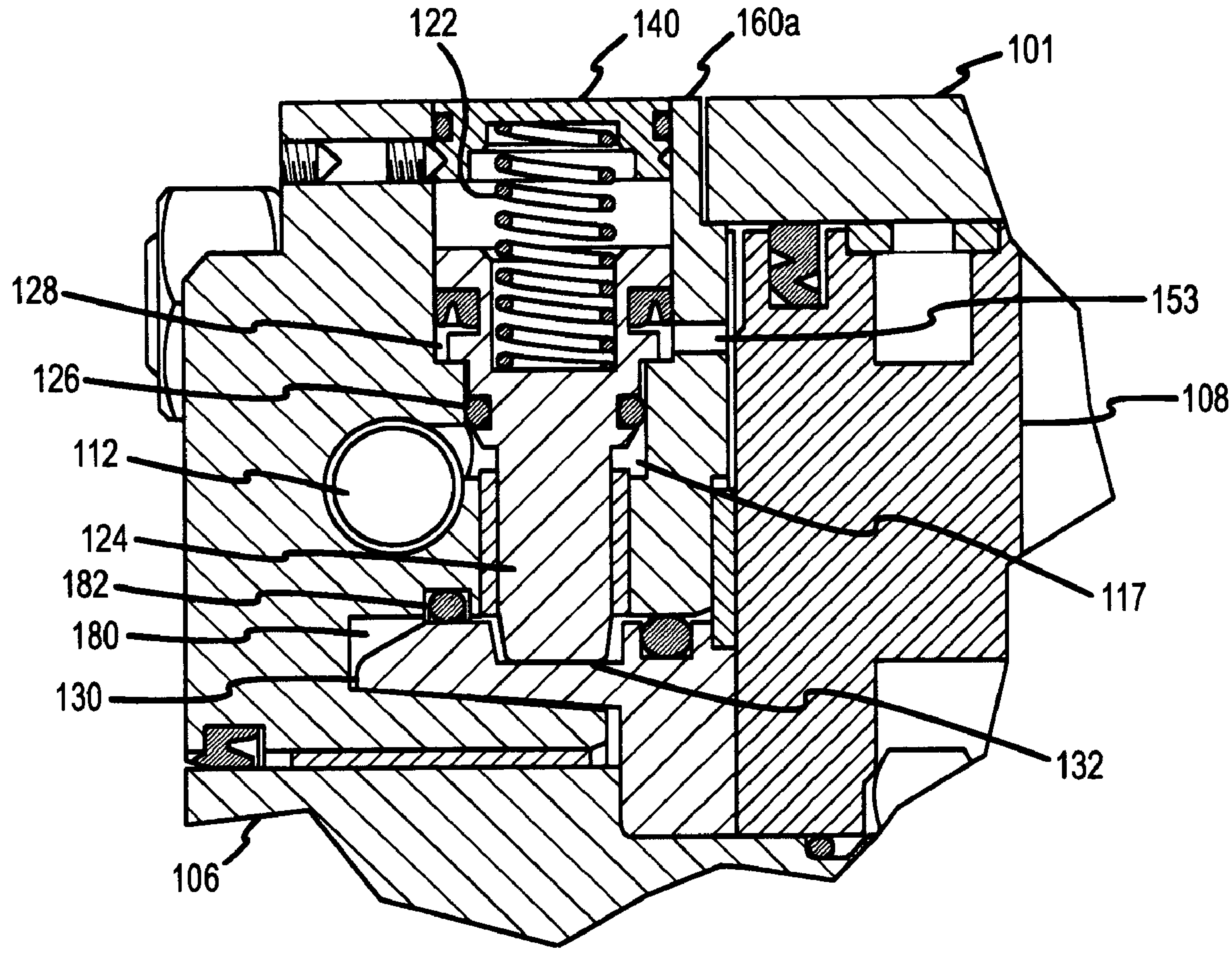


FIG. 6

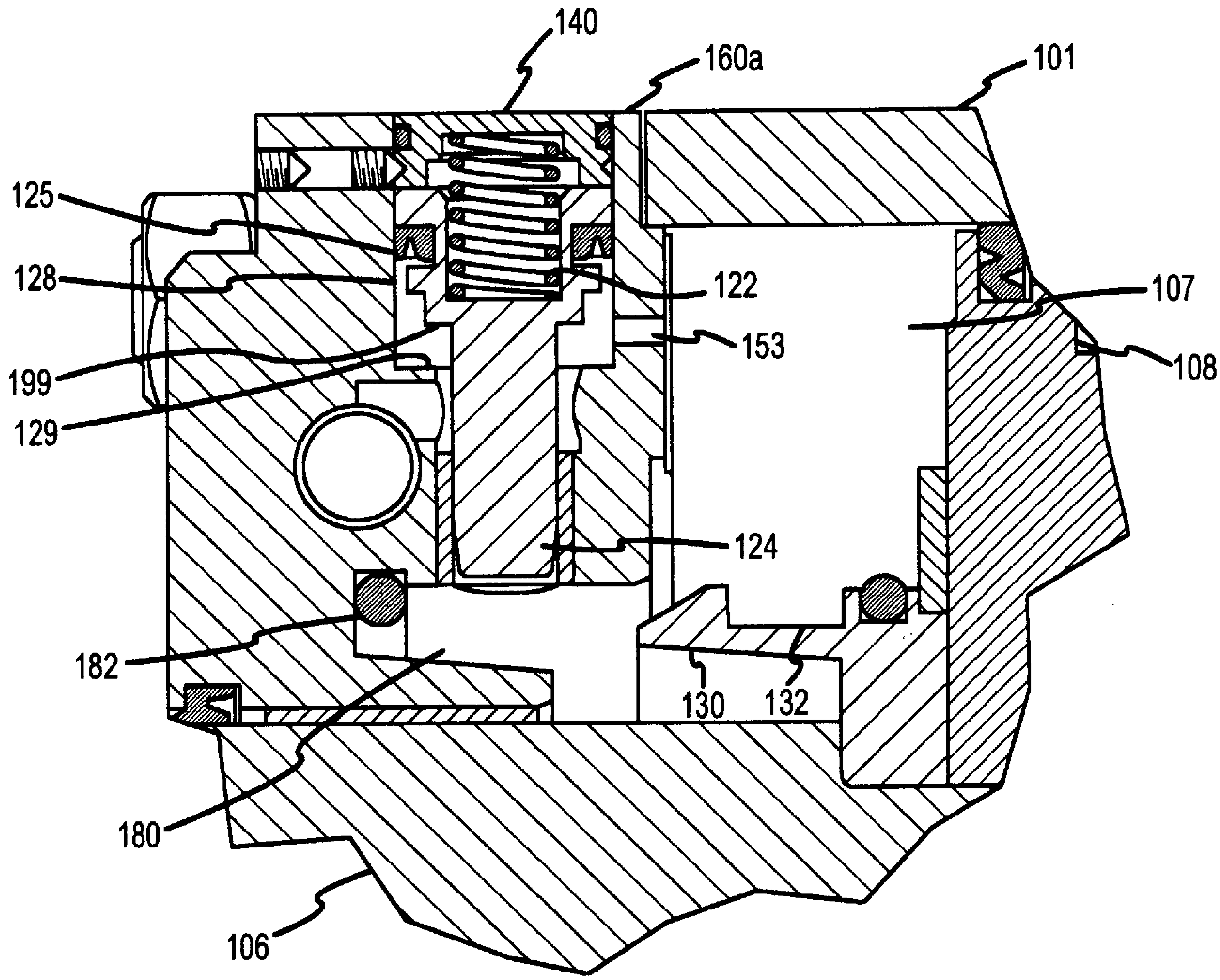

140
160a
101
125
128
122
107
199
153
108
129
124
182
130
132
180
106

FIG. 7

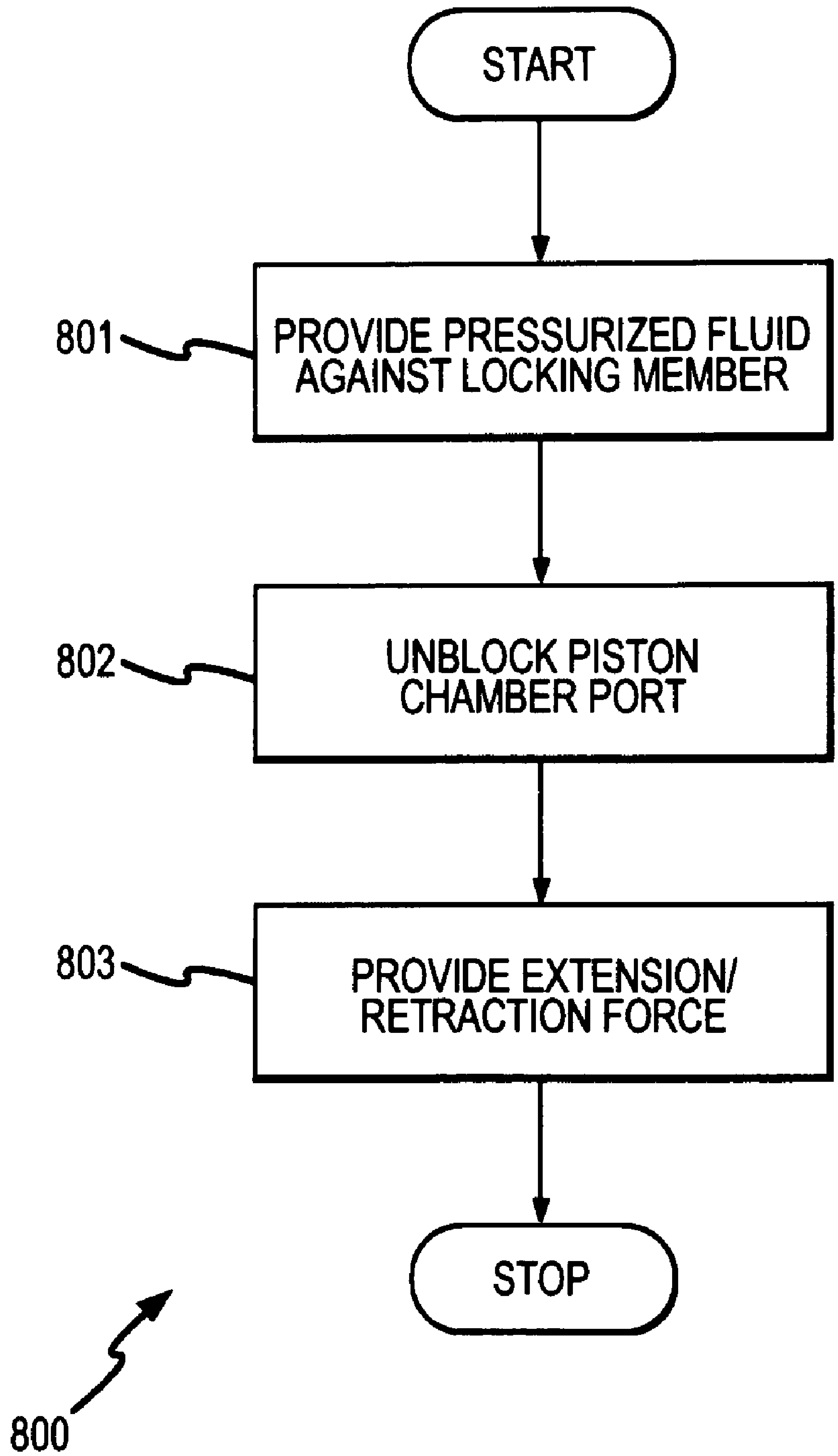

START
801
PROVIDE PRESSURIZED FLUID AGAINST LOCKING MEMBER
802
UNBLOCK PISTON CHAMBER PORT
803
PROVIDE EXTENSION/ RETRACTION FORCE
STOP
800

FIG. 8

LOCKING PISTON ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a piston assembly, and more particularly, to a locking piston assembly.

2. Statement of the Problem

A piston assembly comprises a piston head positioned in a piston chamber. The piston head moves reciprocally in the piston chamber in response to the introduction and/or removal of a pressurized liquid or a pressurized gas. One type of piston assembly is a piston actuator that can be used to convert fluid pressure into mechanical work or vice versa. The piston head is coupled to a piston rod. The piston rod can be connected to any manner of mechanism or device, wherein the piston assembly can be operated in a reciprocating manner and therefore can be used to perform mechanical work.

In some applications, it is desirable that the actuator be locked in an extended position, be locked in a retracted position, or both. For example, in industrial or manufacturing equipment, a locking piston assembly may be needed for purposes of safety of human operators. This includes a locking capability in the event of the loss of a pressurizing fluid used in the piston assembly.

In the prior art, a mechanical lock typically includes a pin or tab that must hold the piston head and piston rod against a force created by a pressurized hydraulic fluid. This forces the lock mechanism to be unnecessarily robust, large, and heavy.

SUMMARY OF THE INVENTION

A locking piston assembly is provided according to an embodiment of the invention. The locking piston assembly comprises a piston chamber, a piston rod configured to be substantially extended from and substantially retracted into the piston chamber, and a piston head coupled to the piston rod and configured to move reciprocally in the piston chamber. The locking piston assembly further comprises at least one lock configured to mechanically lock the piston head and the piston rod in at least a substantially fully extended position and configured to unlock the piston head and the piston rod in a presence of a pressurized fluid provided to retract the piston rod. The pressurized fluid is introduced into the piston chamber and the piston rod is retracted only after the at least one lock is unlocked.

A locking piston assembly is provided according to an embodiment of the invention. The locking piston assembly comprises a piston chamber, a piston rod configured to be substantially extended from and substantially retracted into the piston chamber, and a piston head coupled to the piston rod and configured to move reciprocally in the piston chamber. The locking piston assembly further comprises at least one latch ring extending from the piston head and at least one lock configured to engage the at least one latch ring in order to mechanically lock the piston head and the piston rod in at least a substantially fully extended position in an absence of a pressurized fluid in the lock. The at least one lock is configured to disengage the at least one latch ring in order to unlock the piston head and the piston rod upon introduction of the pressurized fluid that is provided to retract the piston rod.

A method of unlocking a piston rod of a locking piston assembly is provided according to an embodiment of the invention. The method comprises providing pressurized fluid against an inlet region of a locking member of a lock in opposition to a normally-closed biasing force. The pressurized fluid moves the locking member in opposition to the biasing force and to an unlocked position. The method further comprises the locking member unblocking a piston chamber port extending to a piston chamber. The unblocking occurs substantially at an end of an opening travel of the locking member. The pressurized fluid travels into the piston chamber and causes the retraction of the piston rod.

ASPECTS OF THE INVENTION

In one embodiment of the locking piston assembly, the at least one lock locks the piston head and the piston rod in a substantially fully retracted position.

In another embodiment of the locking piston assembly, the at least one lock locks the piston head and the piston rod in an absence of a pressurized fluid in the at least one lock.

In yet another embodiment of the locking piston assembly, the locking piston assembly further comprises at least one latch ring extending from the piston head, with the at least one lock engaging the at least one latch ring.

In yet another embodiment of the locking piston assembly, the locking piston assembly further comprises at least one latch ring extending from the piston head and a lock groove formed in the at least one latch ring, with the at least one lock engaging the lock groove of the at least one latch ring.

In yet another embodiment of the locking piston assembly, the at least one lock further comprises a biasing member, a locking member, a locking member upper seal configured to continuously seal the locking member to a lock bore configured to receive the locking member, and a locking member lower seal configured to block and unblock a piston chamber port extending between the lock bore and a piston chamber, wherein the locking member and the locking member lower seal block the piston chamber port when in a lock position and unblock the piston chamber port when in an unlock position.

In yet another embodiment of the locking piston assembly, an upper seal cross-sectional area is greater than a lower seal cross-sectional area, wherein the lower seal cross-sectional area requires a first pressure to move the locking member to an open position and the upper seal cross-sectional area requires a second pressure to keep the locking member at the open position, and wherein the first pressure is greater than the second pressure.

In yet another embodiment of the locking piston assembly, an unlocking operation comprises providing pressurized fluid against an inlet region of the locking member in opposition to a normally-closed biasing force, with the pressurized fluid moving the locking member in opposition to the biasing force and to an unlocked position, and the locking member unblocking a piston chamber port extending to a piston chamber, with the unblocking occurring substantially at an end of opening travel of the locking member, wherein the pressurized fluid travels into the piston chamber and causes the retraction of the piston rod.

In yet another embodiment of the locking piston assembly, the pressurized fluid is introduced into the piston chamber and the piston rod is retracted only after the at least one lock is unlocked.

In one embodiment of the method, the piston rod of the locking piston assembly is locked in at least a substantially fully extended position by the lock.

In another embodiment of the method, the piston rod of the locking piston assembly is locked in at least a substantially fully retracted position by the lock.

In yet another embodiment of the method, the moving moves the locking member substantially out of engagement with a latch ring extending from a piston head that is coupled to the piston rod.

In yet another embodiment of the method, the moving moves the locking member substantially before an extension or retraction force is placed on the piston rod.

In yet another embodiment of the method, the unblocking occurs during an opening travel of the locking member.

In yet another embodiment of the method, the unblocking occurs substantially at an end of an opening travel of the locking member.

DESCRIPTION OF THE DRAWINGS

The same reference number represents the same element on all drawings. It should be understood that the drawings are not necessarily to scale.

FIG. **1** shows a locking piston assembly according to an embodiment of the invention.

FIG. **2** is an end view of the locking piston assembly according to an embodiment of the invention.

FIG. **3** is a cutaway perspective view of the locking piston assembly according to an embodiment of the invention.

FIG. **4** is an enlarged cross-sectional view of a region of the locking piston assembly including the lock.

FIG. **5** shows the enlarged cross-sectional view where the locking member remains in an unlock position, but where full extension of the piston rod has been completed.

FIG. **6** shows the enlarged cross-sectional view when the locking piston assembly is fully locked.

FIG. **7** shows an enlarged cross-sectional view of an embodiment of the invention.

FIG. **8** is a flowchart of a method of unlocking a piston rod of a locking piston assembly according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

FIGS. **1-8** and the following description depict specific examples to teach those skilled in the art how to make and use the best mode of the invention. For the purpose of teaching inventive principles, some conventional aspects have been simplified or omitted. Those skilled in the art will appreciate variations from these examples that fall within the scope of the invention. Those skilled in the art will appreciate that the features described below can be combined in various ways to form multiple variations of the invention. As a result, the invention is not limited to the specific examples described below, but only by the claims and their equivalents.

FIG. **1** shows a locking piston assembly **100** according to an embodiment of the invention. Components in common with other figures share reference numbers. The locking piston assembly **100** includes a piston body **101**, one or more end caps **160**, and a piston rod **106**. The piston rod **106** can be retracted into the piston body **101** (solid lines) and can be extended from the piston body **101** (dashed lines).

The locking piston assembly **100** can be operated by introduction of a pressurized fluid into the piston body **101** through ports **110**. The pressurized fluid in one embodiment comprises a liquid, such as a hydraulic fluid, for example. The pressurized fluid in another embodiment comprises a gas, such as air, for example.

The locking piston assembly **100** includes at least one lock **120** formed in an end cap **160**. The lock **120** mechanically locks the piston rod **106**. In the embodiment shown, the locking piston assembly **100** includes two end caps **160***a* and **160***b* and two locks **120***a* and **120***b* at both ends of the piston body **101**. When the lock **120***a* in the end cap **160***a* is actuated, then the piston rod **106** can be locked in a fully extended position. Alternatively, when the lock **120***b* in the opposite end cap **160***b* is actuated, then the piston rod **106** can be locked in a fully retracted position. Alternatively, the locking piston assembly **100** can include two locks **120***a* and **120***b*. wherein the piston rod **106** can be locked at both the extended and retracted positions.

Because the lock **120** is formed in the end cap **160**, the lock **120** can be easily installed to the locking piston assembly **100**. Furthermore, the lock **120** can be easily accessed for maintenance and/or repair.

It should be understood that various numbers of locks **120** can be included in an individual end cap. One lock **120** is shown in an end cap **160** for the purpose of simplicity. However, multiple locks **120** can be radially positioned in an end cap **160**. For example, an end cap **160** could include four symmetrically spaced locks **120** that all engage the latch ring **130**.

When locked, the lock **120** remains in the locked position even in the event of loss of pressurized fluid. The lock **120** further cuts off the supply of pressurized fluid, wherein the lock **120** does not have to operate against an internal actuation pressure (see FIGS. **4-6** and the accompanying discussion). In this manner, the lock **120** does not have to be as robust as piston locks in the prior art. The lock **120** only holds the piston rod **106** and associated piston head **108**, and does not have to oppose a force generated by a pressurized fluid in the locking piston assembly **100**.

FIG. **1** and the following figures show and discuss a lock for a piston assembly. However, it should be understood that the lock can equally apply to valves, including diaphragm valves, spool valves, etc., or other devices employing a pressurized fluid that moves a piston, valve, plunger, etc.

FIG. **2** is an end view of the locking piston assembly **100** according to an embodiment of the invention. The lock **120** includes a locking member **124** and a biasing device **122** that urges the locking member **124** down into engagement with a latch ring **130** of the piston rod **106** or piston head **108**. In addition, the end cap **160** includes the port **110**, a first cross-connect passage **111** that connects to the port **110**, and a second cross-connect passage **112** that connects to the first cross-connect passage **111**. The second cross-connect passage **112** communicates with the lock **120**. A pressurized fluid can flow to and from the lock **120** via the port **110**, the first cross-connect passage **111**, and the second cross-connect passage **112**.

FIG. **3** is a cutaway perspective view of the locking piston assembly **100** according to an embodiment of the invention. The figure shows the piston body **101** including an end cap **160** and the second cross-connect passage **112**. It can be seen that the second cross-connect passage **112** delivers pressurized fluid to an inlet region **117** of the lock **120***a* in one embodiment. Although only one lock **120***a* is shown, the figure applies to both locks **120***a* and **120***b*.

A piston head **108** is positioned in and moves in a piston chamber **107** in the piston body **101** in response to introduction/exhaust of pressurized fluid. The piston head **108** is coupled to the piston rod **106**. The piston head **108** includes a latch ring **130** that is engaged by the locking member **124** of the lock **120** (see also FIGS. **4-6**). The latch ring **130** includes a lock groove **132** that receives an end of the locking member **124**. The latch ring **130** extends from the piston head **108**. In one embodiment, the latch ring **130** is formed as part of the piston head **108** or piston rod **106**. Alternatively, the latch ring **130** can be affixed to these two components in some manner.

It can be seen from this figure that the locking member **124** engages the lock groove **132** and the latch ring **130** only when the piston rod **106** and the piston head **108** are at a fully extended position. The lock **120***a* therefore locks the piston rod **106** in the fully extended position. As a consequence, when the piston rod **106** is at the fully extended position, the lock **120***a* prevents retraction. This is true even in the event of a loss of the pressurized fluid in the locking piston assembly **100**. Therefore, the lock **120***a* can maintain the piston rod **106** in the fully extended position. It should be remembered that the lock **120***b* can similarly lock the locking piston assembly **100** when the piston rod **106** is in a fully retracted position.

The biasing device **122** of the lock **120** pushes the locking member **124** downward. In the absence of pressurized fluid to actuate the lock **120**, the biasing device **122** will force the locking member **124** down into the lock groove **132**.

It can be seen from the figure that the piston head **108** and the latch ring **130** can rotate and yet not affect the operation of the lock **120**. Therefore, the piston head **108** and the piston rod **106** do not need to be constrained against rotation.

FIG. **4** is an enlarged cross-sectional view of a region of the locking piston assembly **100** including the lock **120**. This figure shows all relevant components of the lock **120**. In this figure, the piston rod **106** is between retracted and extended positions. As a result, there is pressurized fluid in the piston chamber **107** and in the second cross-connect passage **112**. The lock **120** cannot engage, and the piston rod **106** is moved by regulation of the pressurized fluid.

The lock **120** includes a top cap **140** and top cap seal **141**. The top cap **140** fits into a lock bore **128** in the end cap **160** and affixes to the end cap **160**. The lock bore **128** can include one or more bore portions. The top cap **140** in one embodiment is affixed to the end cap **160** by one or more set screws **144** (see also FIGS. **1** and **3**). The top cap **140** further includes a top cap chamber **142** for receiving a portion of the biasing device **122**.

The locking member **124** further includes a locking member chamber **127** for receiving the biasing device **122**. In addition, the locking member **124** includes a locking member upper seal **125** and a locking member lower seal **126**. Both the upper seal **125** and the lower seal **126** engage the lock bore **128** and enable the locking member **124** to move reciprocally in the lock bore **128**. The upper seal **125** is in continuous contact with the lock bore **128**. In contrast, the lower seal **126** in the embodiment shown can come into contact with and move away from a shoulder **129** formed in the lock bore **128**.

The lock **120** is received in the lock bore **128** formed in the end cap **160**. The lock bore **128** extends down to a latch ring bore **180** in the end cap **160**. The latch ring bore **180** corresponds to and receives the latch ring **130**. The latch ring bore **180** in one embodiment is substantially annular in shape. The latch ring bore **180** includes a latch ring bore seal **182** that fits to the latch ring **130** when the piston rod **106** is substantially fully extended.

The latch ring **130** further includes a latch ring seal groove **134** and a latch ring seal **135**. The latch ring seal **135** seals the piston head **108** to the end cap **160** when the piston rod **106** is substantially fully extended.

When pressurized fluid is introduced into the piston chamber **107**, the piston head **108** will move to the right in the figure and the piston rod **106** will be retracted. The pressurized fluid is introduced through the second cross-connect passage **112**, around the locking member **124**, up to the piston chamber port **153**, and then through the piston chamber port **153** into the piston chamber **107**. It should be understood that correspondingly the fluid on the right of the piston head **108** is vented.

It should be noted that when the latch ring bore seal **182** loses contact with the latch ring **130** and the latch ring seal **135** loses contact with the end cap **160**, then a maximum area of the piston head **108** is subjected to the pressurized fluid. The pressurized fluid is supplied at a large volume by the bore **113** of FIG. **2**. As a result, a maximum force acts on the piston head **108** to retract the piston rod **106**.

In some embodiments, an upper seal cross-sectional area is greater than a lower seal cross-sectional area. Therefore, the lower seal cross-sectional area requires a first pressure to move the locking member to an open position and the upper seal cross-sectional area requires a second pressure to keep the locking member at the open position. In some embodiments, the first pressure is greater than the second pressure.

When pressurized fluid is vented from the second cross-connect passage **112** and therefore the piston chamber **107**, the piston head **108** will move to the left in the figure. It should be understood that the venting will be accompanied by a supply of pressurized fluid to a second piston chamber (not shown) on the right side of the piston head **108**.

FIG. **5** shows the enlarged cross-sectional view where the locking member **124** remains in an unlocked position, but where full extension of the piston rod **106** has been completed. When the piston head **108** is substantially in contact with the end cap **160**, then the latch ring **130** will enter the latch ring bore **180** and the latch ring bore seal **182** will contact the latch ring **130**. In addition, the latch ring seal **135** will contact the end cap **160**. The lock **120** can now be actuated and moved into engagement with the latch ring **130**. Therefore, pressurized fluid is maintained on the right side of the piston head **108** and pressurized fluid continues to be vented from the second cross-connect passage **112**. However, in this figure, the pressure in the inlet region **117** has not yet substantially dropped and therefore the locking member **124** is still in the unlocked position.

FIG. **6** shows the enlarged cross-sectional view when the locking piston assembly **100** is fully locked. In this figure, the venting of pressurized fluid from the inlet region **117** (and therefore from the piston chamber **107**) has continued until the piston head **108** contacts the end cap **160**. During the venting, due to the available surface area of the upper region of the locking member **124**, pressure on the locking member **124** will remain at a sufficient level to overcome the biasing device **122** and keep the locking member **124** in an upward, unlocked position.

However, as the pressure drops below a predetermined holding level, the locking member **124** is forced downward into a locking position by the biasing device **122**. As a result, the locking member lower seal **126** contacts the shoulder **129** of the lock bore **128**, thereby sealing the lock bore **128**. As a result, any pressurized fluid in the second cross-connect passage **112** cannot pass up through the lock bore **128** into the piston chamber port **153**.

At this time, the locking member **124** drops into the locking groove **132** of the latch ring **130**. The piston rod **106** is therefore locked at a fully extended position.

Although the locking operation has been illustrated and discussed for the lock **120***a* and therefore for a lock operation at a full extension of the piston rod **106**, it should be understood that the locking operation equally applies to the lock **120***b* and therefore for a lock operation at a full retraction of the piston rod **106**.

Unlocking is essentially the reverse of the locking operation. When unlocking commences, pressurized fluid is first vented from the right side of the piston head **108** (see FIG. **6**). Then, pressurized fluid is introduced into the inlet region **117** through the second cross-connect passage **112**. The pressurized fluid counteracts the biasing device **122** and moves the locking member **124** upward to an unlock position (see FIG. **5**). The movement of the locking member **124** to the unlock position is a first step in the piston rod retraction operation. When the locking member lower seal **126** lifts up and away from the shoulder **129** in order to move the piston head **108**, the locking member **124** has already been retracted from the latch ring **130**. Therefore, the piston rod **106** cannot move before it is unlocked. When the locking member **124** has moved fully upward, then the pressurized fluid can travel through the piston chamber port **153** into the piston chamber **107**, causing the piston head **107** to move to the right and retract the piston rod **106** (see FIG. **4**). Until the lower seal **126** loses contact with the lock bore **128**, the opening pressure provided by the pressurized fluid will press upward on the locking member **124**. Therefore, in operation, the locking member **124** will move fully upward if a satisfactory pressure is provided by the pressurized fluid. The required lifting pressure is controlled by the biasing force provided by the biasing device **122**, in combination with the available diameter/area of the locking member **124** and the locking member lower seal **126**. The pressure required to move the locking member **124** to the open position is greater than a pressure required to maintain the locking member **124** in the unlock position. However, the pressure supplied by the second cross-connect passage **112** in one embodiment will easily exceed the pressure needed to lift the locking member **124**.

FIG. **7** shows an enlarged cross-sectional view of an embodiment of the invention. In this embodiment, the locking member **124** includes the locking member upper seal **125**. Instead of the locking member lower seal **126**, in this embodiment the locking member **124** includes a shoulder **199** that seats onto and overhangs the shoulder **129** of the lock bore **128**. This shoulder-to-shoulder contact can seal the piston chamber port **153** from the second cross-connect passage **112**. Alternatively, any manner of seal, gasket, etc., can be further included between the two components, including a seal positioned on the shoulder **129** of the lock bore **128**.

FIG. **8** is a flowchart **800** of a method of unlocking a piston rod of a locking piston assembly according to an embodiment of the invention. In step **801**, a pressurized fluid is provided against a locking member. The locking member locks a piston head/piston rod of the locking piston assembly. The locking member can lock the piston head/piston rod in a fully extended position or in a fully retracted position. The pressurized fluid can comprise a pressurized liquid or a pressurized gas, as previously discussed. The pressurized fluid is provided against an inlet region of the locking member and is in opposition to a normally-closed biasing force. The biasing force is provided by a biasing device, as previously discussed. As a result of the introduction of the pressurized fluid, the locking member is moved in opposition to the biasing force and is therefore moved into an unlocked position. Consequently, the locking member is moved out of engagement with a latch ring that extends from a piston head that is coupled to the piston rod. The moving moves the locking member before an extension or retraction force is placed on the piston rod.

In step **802**, the movement of the locking member unblocks a piston chamber port. The piston chamber port extends between a piston chamber and a source of pressurized fluid, such as a second cross-connect passage in one embodiment. Pressurized fluid therefore can travel into the piston chamber and can move the piston head. In one embodiment, the unblocking occurs during an opening travel of the locking member. In another embodiment, the unblocking occurs substantially at an end of an opening travel.

In step **803**, an extension/retraction force can be provided into the piston chamber via the piston chamber port. The extension/retraction force is provided by regulation of the pressurized fluid. If the lock is located on a piston rod end of the of the locking piston assembly (as in FIGS. **3-7**), then a retraction force is provided by the piston chamber port. However, if the lock is located at an opposite end of the locking piston assembly (see lock **120***b* of FIG. **1**), then an extension force is provided by the piston chamber port.

The locking piston assembly according to the invention can be employed according to any of the embodiments in order to provide several advantages, if desired. The invention provides a locking piston assembly that mechanically locks in an absence of a pressurized fluid. The invention provides a locking piston assembly that unlocks only upon the introduction of a pressurized fluid. The invention provides a locking piston assembly wherein the lock releases before a pressurized fluid is provided into a piston chamber. The invention provides a locking piston assembly wherein less pressure is required to hold the lock in an unlock position than is required to move the lock to the unlock position. The invention provides a locking piston assembly wherein the lock does not have to counter a force generated by a pressurized fluid in the piston assembly. The invention provides a locking piston assembly wherein the piston head and piston rod do not need to be constrained against rotation. The invention provides a locking piston assembly that does not increase an overall size of the piston assembly.

What is claimed is:

1. A locking piston assembly (**100**) including a piston chamber (**107**), a piston rod (**106**) configured to be substantially extended from and substantially retracted into the piston chamber (**107**), and a piston head (**108**) coupled to the piston rod (**106**) and configured to move reciprocally in the piston chamber (**107**), with the locking piston assembly (**100**) being characterized by:

at least one lock (**120**) configure to mechanically lock the piston head (**108**) and the piston rod (**106**) in at least a substantially filly extended position and configured to unlock the piston head (**108**) and the piston rod (**106**) in a presence of a pressurized fluid provided to retract the piston rod (**106**), with the at least one lock (**120**) comprising:

a biasing member (**122**);

a locking member (**124**);

a locking member upper seal (**125**) configured to continuously seal the locking member (**124**) to a lock bore (**128**) configured to receive the locking member (**124**); and

a locking member lower seal (**126**) configured to block and unblock a piston chamber port (**153**) extending between the lock bore (**128**) and piston chamber (**107**) with an upper cross-sectional area being greater than a lower seal cross-sectional area, wherein the lower seal cross-sectional area requires a first pressure to move the locking member (**124**) to an open position and the upper seal cross-sectional area requires a second pressure to keep the locking member (**124**) at the open position , and wherein the first pressure is greater than the second pressure;

wherein the locking member (**124**) and the locking member (**126**) block the piston chamber port (**153**) when in a lock position and unblock the piston chamber port (**153**) when in an unlock position and wherein the pressurized fluid is introduced into the piston chamber (**107**) and the piston rod (**106**) is retracted only after the at least one lock (**120**) is unlocked.

2. The locking piston assembly (**100**) of claim **1**, with the at least one lock (**120**) locking the piston head (**108**) and the piston rod (**106**) in a substantially fully retracted position.

3. The locking piston assembly (**100**) of claim **1**, with the at least one lock (**120**) locking the piston head (**108**) and the piston rod (**106**) in an absence of a pressurized fluid in the at least one lock (**120**).

4. The locking piston assembly (**100**) of claim **1**, further comprising at least one latch ring (**130**) extending from the piston head (**108**), with the at least one lock (**120**) engaging the at least one latch ring (**130**).

5. The locking piston assembly (**100**) of claim **1**, further comprising:

at least one latch ring (**130**) extending from the piston head (**108**); and

a lock groove (**132**) formed in the at least one latch ring (**130**), with the at least one lock (**120**) engaging the lock groove (**132**) of the at least one latch ring (**130**).

6. The locking piston assembly (**100**) of claim **1**. with an unlocking operation comprising:

providing pressurized fluid against an inlet region (**117**) of the locking member (**124**) in opposition to a normally-closed biasing force, with the pressurized fluid moving the locking member (**124**) in opposition to the biasing force and to an unlocked position; and

the locking member (**124**) unblocking a piston chamber port (**153**) extending to a piston chamber (**107**), with the unblocking occurring substantially at an end of opening travel of the locking member (**124**), wherein the pressurized fluid travels into the piston chamber (**107**) and causes the retraction of the piston rod (**106**).

7. A locking, piston assembly (**100**) including a piston chamber (**107**), a piston rod (**106**) configured to be substantially extended from and substantially retracted into the piston chamber (**107**), and a piston head (**108**) coupled to the piston rod (**106**) and configured to move reciprocally in the piston chamber (**107**), with the locking piston assembly (**100**) being characterized by:

at least one latch ring (**130**) extending from the piston head (**108**); and

at least one lock (**120**) configured to engage the at least one latch ring (**130**) in order to mechanically lock the piston head (**108**) and the piston rod (**106**) in at least a substantially fully extended position in an absence of a pressurized fluid in the lock (**120**) and configured to disengage the at least one latch ring (**130**) in order to unlock the piston head (**108**) and the piston rod (**106**) upon introduction of the pressurized fluid that is provided to retract the piston rod (**106**), with the at least one lock (**120**) comprising;

a biasing member(**122**);

a locking member (**124**);

a locking member upper seal (**125**) configured to continuously seal the locking member (**124**) to a lock bore(**128**) configured to receive the locking member (**124**); and

a locking member lower seal (**126**) on red to block and unblock a piston chamber port (**153**) extending between the lock bore (**128**) and a piston chamber (**107**), with an upper seal cross-sectional area being greater than a lower seal cross-sectional area, wherein the lower seal cross-sectional area requires a first pressure to move the locking member (**124**) to an open position and the upper seal cross-sectional area requires a second pressure to keep the locking member (**124**) at the open position, and wherein the first pressure is greater than the second pressure;

wherein the locking member (**124**) and the locking member lower seal (**126**) block the piston chamber port (**153**) when in a lock position and unblock the piston chamber port (**153**) when in an unlock position and wherein the pressurized fluid is introduced into the Mon chamber (**107**) and the piston rod (**106**) is retracted only after the at least one lock (**120**) is unlocked.

8. The locking piston assembly (**100**) of claim **7**, further comprising the at least one lock (**120**) locking the piston head (**108**) and the piston rod (**106**) in a substantially fully retracted position.

9. The locking piston assembly (**100**) of claim **7**, with the at least one lock (**120**) locking the piston head (**108**) and the piston rod (**106**) in an absence of a pressurized fluid in the at least one lock (**120**).

10. The locking piston assembly (**100**) of claim **7**, further comprising a lock groove (**132**) formed in the at least one latch ring (**130**), with the at least one lock (**120**) engaging the lock groove (**132**) of the at least one latch ring (**130**).

11. The locking piston assembly (**100**) of claim **7**, with an unlocking operation comprising:

providing pressurized fluid against an inlet region (**117**) of the locking member (**124**) in opposition to a normally-closed biasing force, with the pressurized fluid moving the locking member (**124**) in opposition to the biasing force and to an unlocked position; and

the locking member (**124**) unblocking a piston chamber port (**153**) extending to a piston chamber (**107**), with the unblocking occurring substantially at an end of opening travel of the locking member (**124**), wherein the pressurized fluid travels into the piston chamber (**107**) and causes the retraction of the piston rod (**106**).

12. A method of unlocking a piston rod of a locking piston assembly, the method comprising:

providing pressurized fluid against an inlet region of a locking member of a lock in opposition to a normally-closed biasing force, with the pressurized fluid moving the locking member in opposition to the biasing force and to an unlocked position, wherein a first pressure moves the locking member to an open position and a second pressure keeps the locking member at the open position, and wherein the first pressure is greater than the second pressure; and

the locking member unblocking a piston chamber port extending to a piston chamber, wherein the pressurized fluid travels into the piston chamber and causes the retraction of the piston rod, wherein the pressurized fluid is introduced into the piston chamber and the piston rod is retracted only after the at least one lock is unlocked.

13. The method of claim **12**, with the piston rod of the locking piston assembly being locked in at least a substantially fully extended position by the lock.

14. The method of claim **12**, with the piston rod of the locking piston assembly being locked in at least a substantially filly retracted position by the lock.

15. The method of claim **12**, wherein the moving moves the locking member substantially out of engagement with a latch ring extending from a piston head that is coupled to the piston rod.

16. The method of claim **12**, wherein the moving moves the locking member substantially before an extension or retraction force is placed on the piston rod.

17. The method of claim **12**, with the unblocking occurring during an opening travel of the locking member.

18. The method of claim **12**, with the unblocking occurring substantially at an end of an opening travel of the locking member.

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